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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 09/465,131 | 12/16/1999 | SARATHY RAJAGOPALAN | 65611 | 8489 |
| 24319 | 7590 | 09/23/2004 | EXAMINER | |
| LSI LOGIC CORPORATION 1621 BARBER LANE MS: D-106 LEGAL MILPITAS, CA 95035 | | | GUADALUPE, YARITZA | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2859 | |

DATE MAILED: 09/23/2004

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 09172004

Application Number: 09/465,131

Filing Date: December 16, 1999

Appellant(s): RAJAGOPALAN ET AL.

Eric J. Whitesell
For Appellant

EXAMINER'S ANSWER

This is in response to the supplemental appeal brief filed June 16, 2004.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

The brief contains a statement that there are no related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The amendment filed June 16, 2004 has been entered.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

The rejection of claims 1 - 6 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) *ClaimsAppealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) *Prior Art of Record*

Admitted Prior Art of Record, pages 1 - 2 of the Specification as amended on May 11, 2001.

| | | |
|-----------|----------------|---------|
| 5,995,174 | Wyland | 12-1999 |
| 6,131,579 | Thorson et al. | 10-2000 |
| 5,585,577 | Lemoine et al. | 12-1996 |

(10) *Grounds of Rejection*

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1 and 4 - 5 are rejected under 35 U.S.C. 103 (a) as being unpatentable over the Admitted Prior Art [Hereinafter APA] in view of Wyland (US 5,997,174).

APA discloses a thermal profiling device (See page 2, line 5, as amended on May 11, 2001) comprising a packaging substrate having an upper surface, and a semiconductor die having an active circuit surface secured directly to the upper surface of the packaging substrate. APA also discloses the semiconductor die including an active circuit surface having conductive bumps and the substrate including a plurality of bonding pads formed on the surface and where the semiconductor die is positioned on the substrate such that the conductive bumps are in electrical contact with the bonding pads. APA discloses the substrate and semiconductor die secured in place by a solder bond between the bumps and the bonding pads, securing the thermocouple in position.

APA does not disclose the thermocouple secured directly to the active circuit surface of the semiconductor die as stated in claim 1. However, APA discloses in page 2 of the Specification that the interface temperature between the active circuit surface of a semiconductor die and a substrate is critical during thermal profiling and therefore, enhancements for measuring this interface temperatures are needed.

With respect to claim 1 : APA discloses a flip chip assembly as stated above. Wyland discloses a thermal system for a semiconductor die comprising a thermocouple (117) secured on the junction between surfaces (113, 114) for measuring and controlling a junction / interface

temperature. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide a thermocouple secured to the semiconductor die for measuring the junction / interface temperature as taught by Wyland between the active circuit surface and the substrate disclosed by APA in order to avoid damages due to over heating / over cooling that may affect the overall quality of the circuit and since APA suggests that more accurate measurements of the interface temperature are required.

2. Claim 6 is rejected under 35 U.S.C. 103 (a) as being unpatentable over the Admitted Prior Art [Hereinafter APA] in view of Wyland (US 5,997,174) and further in view of Lemoine et al. (US 5,585,577).

APA and Wyland disclose a device as stated in paragraph 1 above.

APA and Wyland do not disclose the opening passing through the second opposite surface and through the first surface of the packaging substrate as stated in claim 6.

With respect to claim 6 : APA and Wyland disclose a system comprising a thermocouple secured to the semiconductor die as stated above but do not disclose an aperture through the substrate. Lemoine et al. discloses an apparatus having a temperature sensor (32) inserted through a hole / opening (40) in the substrate (10) to locate the sensor directly to a surface / interface to be measured. Therefore, it would have been obvious to a person having ordinary skill

in the art at the time the invention was made to use an opening through the substrate for inserting the thermocouple to be secured directly to the surface as taught by Lemoine et al. in the device disclosed by APA and Wyland since Lemoine is teaching an alternate way to position the thermocouple in order to provide a mechanism to obtain the real temperature of the semiconductor die.

3. Claims 2 – 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Admitted Prior Art [Hereinafter APA] in view of Wyland (US 5,997,174), as applied to claims 1, 4 and 5 above, and further in view of Thorson et al. (US 6,131,579).

APA and Wyland disclose a flip chip assembly as stated in paragraph 1 above.

APA and Wyland do not disclose the thermocouple secured using an adhesive comprising epoxy as stated in claims 2 and 3.

Regarding claims 2 and 3 : Thorson et al. discloses a temperature sensing device having a thermocouple (250) and where an adhesive such as an epoxy (See Column 3, lines 63 – 65) is used in order to held the thermocouple in position. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to use an adhesive as taught by Thorson et al. in the apparatus disclosed by APA and Wyland in order to provide a mechanical protection for the thermocouple and provide an electrical conductor as well as a bonding mechanism.

(11) Response to Argument

INTRODUCTION

The issue in this application is whether a rationale exists for modifying the Admitted Prior Art by the Wyland reference. Also, a secondary issue is whether modifying the Admitted Prior Art by Wyland would arrive at the claimed invention. This Examiner's Answer will show that the alleged deficiencies of the Office Action are clearly disclosed and met by the Admitted Prior Art and the suggested modification with the Wyland reference.

ANALYSIS

Appellant's argues that no motivation exists for modifying the Admitted Prior Art by Wyland. The Examiner strongly disagrees. It is clear from Appellant's disclosure the criticality of acquiring the interface temperature during the thermal profiling of a semiconductor device fabrication. The disclosure recites in detail methods of flip chip-packaging comprising packaging substrates, a semiconductor die of the flip – chip integrated circuit having an active surface (See page 1 of the Specification as amended on May 11, 2001). The disclosures also recites in page 2 of the Specification, as amended on May 11, 2001, " Since it is the interface temperature that is critical, more accurate measurements of the interface temperature are required. Previously, thermal profiling had been done by placing a die on a packaging substrate, then attaching a thermocouple on top of the die and running the substrate through a preheat, melt, cool down

cycle in a reflow process ". According to this, the use of a thermocouple in order to measure and control the interface temperature during process is well known. However, the use of a thermocouple secured directly to the active circuit surface as stated in claim 1 is missing.

Wyland, in the other hand, teaches a device comprising a thermal system for a semiconductor die comprising a thermocouple (117, 119) secured directly on the junction between surfaces (113, 114) for measuring and controlling a junction / interface temperature. It is clear from the Wyland reference that in order to measure the temperature at an interface of two structures, a thermocouple is provided and secured directly to the desired surface that is intended to be monitored. Therefore, Appellant's argument that the thermocouple is attached away from the semiconductor die and therefore teaches away from the claimed subject matter is not persuasive, because Wyland teaches that in order to monitored a junction / interface temperature between surfaces, a thermocouple is directly secured to the desired surface under study.

CONCLUSION

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,


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Appeal Conference Date : July 22, 2003

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